

## **CORPORATE ECONOMIC DISTRESS IN THE WOOD CONSTRUCTION INDUSTRY: CURRENT STATE AND TREND AFTER THE ECONOMIC CRISIS**

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### **Abstract**

*In order to obstruct housing shortage in Sweden, wood is considered as an alternative material for multi-family applications. Yet, more firms are needed to prefabricate wooden elements, volumes or modules in an industrialised way. These could be found amongst firms producing wooden single-family houses; however, they might suffer from economic distress, since their core market dropped by more than 60% in the aftermath of the economic crisis. This study investigates corporate economic distress from 2010 to 2013 of 52 Swedish firms producing wooden single-family houses. This, by applying Altman's Z'-score model, grouping firms into a risk, a grey or a safe zone. Results show that from 2010 to 2013, firms suffering from economic distress decreased from 11.1% to 3.8%. The two remaining firms in the risk zone most likely will face bankruptcy, if no radical action will be taken. Firms in the grey zone increased from 31.1% to 36.5%. The 19 firms in this zone are dependent on appropriate strategies to positively develop their business. Finally, firms in the safe zone increased from 57.8% to 59.7%. These firms are in good economic conditions and can be regarded as potential candidates for investing in a development towards multi-family applications. For the investigated time period, the average Z'-score improvement for the whole industry equals 38%, with a major upturn from 2012 to 2013.*

**Key words:** wooden single-family houses; wooden multi-family houses; economic distress; Z-score model; multi-storey houses.

### **THE SWEDISH WOOD CONSTRUCTION INDUSTRY**

In Sweden, housing shortage accumulated to a level implying that an annual amount of between 40 000 to 60 000 housing units needs to be build, in order to detrend that shortage (Boverket 2012). In the past years, however, the total number of building starts for all type of housing units only increased from about 20 000 units to 31 000 in 2013 (TMF 2013a; 2014a). This 64% increase basically has to be regarded as positive. Yet, housing starts approximately need to be doubled, in order to not only considering the new emerging annual demand, but reducing the accumulated shortage stock as well.

Besides its usage in single-family houses, wood should be considered as a material to be used more often in multi-family house applications as well (a.o. Nord and Widmark 2010). Nevertheless, the market share of wood in multi-family houses only was 10.1% in 2013 (TMF 2013b). To further increase that share, Schauerte *et al.* (2014) proposed that Swedish firms, who produce wooden-single family houses, should be more offensive and engaged in product development towards wooden multi-family houses. Reasons for this strategic movement are e.g. as follows.

To start with, researchers, public purchasers and other actors on the market for wooden multi-family houses request a higher degree of prefabrication in order to accentuate the potential of wood in off-site production (a.o. Stehn and Brege 2007; Lidelöv *et al.* 2015). This potential is already utilised by manufacturers for single-family houses, even though to varying extend. Further development and research needs to be conducted to adjust from single-family to multi-family applications, yet, firms who invest in joint solutions for prefabricated elements, volumes or modules would benefit from economies of scale and scope and consequently gain competitive advantage. The importance of such a strategic conduct for firms in that industry is emphasised by the fact that the market for wooden single-family houses is strongly tending towards perfect competition (Schauerte *et al.* 2014). To further develop on perfect competitive markets, operating firms usually have to strive for product differentiation, e.g. in the current case from the single-family towards the multi-family segment.

Further, Schauerte et al. (2014) showed in their study that the existing market for wooden single-family houses in Sweden ideally could be covered by 19 to 20 firms, instead of the 52 firms included in that study. This equals 38% and implies an uneven distribution of resources for national welfare purposes, since there are too many small firms with a relatively low market share, who nonetheless have fixed assets and professional experience that is not used in an optimal way. It implies as well that 62% of the firms in that industry need to find appropriate strategic actions in order to use their fixed assets and experience in different ways, e.g. to elaborate on product differentiation towards wooden multi-family houses, as described above.

However, product differentiation and developments of any kind often require investments and risk taking by the respective firms. This could probably be a critical factor, considering the aftermath of the economic crisis. From 2007 to 2012, a drop from ca 12 500 to 4 800 finalised houses hit the market hard (TMF 2014b). This equals ca 62% less produced single-family houses within a 5 to 6 years period. In 2013, a slightly upward tendency was observed, and for 2014, 7 000 finalised houses are reported. That positive trend is expected to continue and the forecast for 2015 was recently raised from 8 000 to 9 000 houses (TMF 2014c, 2015). Even though an upward tendency can be seen, the proposed forecast is almost 30 % below the produced quantity from 2007.

Since firms had to struggle with a 62% drop of incoming orders during the crisis, the current financial situation of these firms might lead to corporate economic distress. Such a distress for the individual firm would probably imply that investments and risk taking for product differentiation and development towards multi-family applications hardly could be prioritised. Instead, managerial and strategic action to turn the economic situation to the better would be on the agenda. Therefore, the strategic challenges of firms in the Swedish industry for wooden single-family houses need to be regarded in the light of the consequences of the economic crisis.

## OBJECTIVE

The main purpose of this study is to investigate in the corporate economic distress of Swedish firms producing wooden single-family houses. Here, two objectives are identified. First, using the latest economic figures available, the current state of economic distress in the industry will be revealed. This is important to assess the participating firms' potential to make investments. However, second, an evaluation of the corporate economic distress over a period of some years can give insights into existing trends or tendencies. In case such trends exist, they might be useful in analysing the industry as such and the affected firms in particular.

## METHOD AND THE UNDERLYING THEORETICAL BASE

### Altman's Z' score

Corporate economic distress can be measured in different ways. In general, four types of methods are applied, according to e.g. Crouhy *et al.* (2001): models based on discriminant analysis, linear probability models, probit models and logit models. Trying to predict bankruptcy, many studies have been performed by different authors, e.g. Smith (1930), Beaver (1966), Edmister (1972), or, more recently, Shumway (2001), Hillegeist *et al.* (2004) and Elliott *et al.* (2014). However, in the past decades, particularly one model has been applied by researchers and financial analysts due to its prediction accuracy, i.e. Altman's Z-score model (a.o. Elliot *et al.* 2014 and Gunathilaka 2014). Based on multiple linear discriminant analysis, the Z-score model could show that a firm will turn bankrupt within two years. Achieved levels of accuracy for such predictions were varying between 75% and 90% (Altman *et al.* 2014), Samkin *et al.* (2012) even showed a prediction probability of 95% five years prior to firms' insolvency. Altman's Z-score model was applied in different countries and industries, see Altman *et al.* (2014) for a literature review of 33 studies from 2000 to 2014.

In the original Z-score model, five variables were included. These were chosen, considering e.g. their contribution to prediction accuracy and their inter-correlation (Altman 1968). However, this model was developed for publically listed firms and had to be further developed, to allow for private industry firms to be included as well. Modifying from the Z-score to the Z'-score, Altman re-assessed and replaced variables towards a more suitable approach for private firms. The resulting model is shown in the linear relationship in equation [1] (Altman 1983):

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.42X_4 + 0.998X_5 \quad (1)$$

where:  $X_1$ =working capital/total assets,  $X_2$ =retained earnings/total assets,  $X_3$ =EBIT/total assets,  $X_4$ =book value equity/total liabilities and  $X_5$ =sales/total assets. These five ratios belong to different

economic key number categories, i.e. liquidity, profitability, leverage, solvency and activity and can be interpreted as follows:

$X_1$ : *working capital/total assets*. Working capital is calculated as current assets minus current liabilities, and represents the money that a firm can have available at relatively short notice (Skärvad and Olsson 2011). Total assets include all assets on the balance sheet. This ratio thus describes a firm's liquidity in relation to its size and its ability to meet short-term debts (Al-Rawi *et al.* 2008).

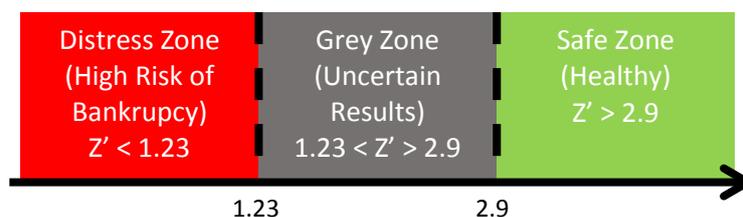
$X_2$ : *retained earnings/total assets*. Measuring retained earnings gives a picture of what a firm did with its profits (minus dividends and taxes) since the firm's inception. This ratio reflects a firm's cumulative profitability over time, hereby implicitly considering the firm's age and earning power (Altman 1968). This, since research showed that the risk for failure of firms is related to the age of the firm (Dun & Bradstreet 1994, Eidleman 1995).

$X_3$ : *EBIT/total assets*. EBIT measures profitability or earnings before interests and taxes. Here, interests and taxes are excluded, since these can have a positive or negative impact on earnings, yet, only representing a one-time effect. This leverage ratio reflects a firm's earning power of its assets (Muthukumar and Sekar 2014).

$X_4$ : *book value equity/total liabilities*. In this solvency ratio, the book value of all assets according to the balance sheet is measured in relation to the total amount of the firm's debts. If the book value of equity of a firm is less than its total liabilities, i.e. this ratio is negative, a firm can become insolvent in the short run and bankrupt in the long run (Taurell and Augustsson 2012).

$X_5$ : *sales/total assets*. This activity ratio measures a firm's asset's sales generating capacity, as well referred to as the manufacturing capacity of the firm's assets (Taurell and Augustsson 2012) or the management's capacity to compete on the market (Muthukumar and Sekar 2014, Altman *et al.* 2014).

The values for the independent variables  $X_1$  to  $X_5$  are multiplied with the respective discriminant coefficients according to equation [1], and the resulting  $Z'$ -scores interpreted by using pre-calculated classification zones or cut-off scores, as presented in Fig. 1.



**Fig. 1.**  
**Z'-Score Classification Areas and cut-off levels (Altman *et al.* 2013)**

Fig. 1 shows three classification zones with their respective cut-off levels. A  $Z'$ -score below 1.23 implies that the firm is in the distress zone and probably will face bankruptcy, if no appropriate strategic actions will be taken by the firm's management. Firms with  $Z'$ -scores between 1.23 and 2.9 find themselves in a grey zone, i.e. a relatively uncertain situation of the financial results. Finally,  $Z'$ -scores of 2.9 or higher indicate that firms' financial situations can be regarded as healthy. These firms face limited economic risk situations and have promising potential for future activities (Altman 2001). These three categories can help and support decision making and developing investment strategies.

#### Data collection

The firms to be investigated in this study need to be producers of wooden single-family houses and be located in Sweden. The selection process had its starting point in a statistical online database for Swedish wooden single-family houses. The resulting list of firms was further edited by removing firms that were operating as carpenters, being too small in terms of employees. As a cut-off level, 10 employees were chosen. This resulted in a list of 52 firms. Different ownership models between these firms were not considered, which is a limitation of this study.

Since sensitive competitive relationships exist between these firms, disclosing tender economic positions of firms, which could be used for competitive actions on the market, could harm the professional contact between these firms and the authors' university. Therefore, no names of firms are revealed in this study and the firms handled as anonymous units of analysis.

For the chosen 52 firms, all necessary economic data to calculate the  $Z'$ -score according to equation (1) was collected from their balance sheets for the years 2010 to 2013. This four-year period

was chosen, since balance-sheets for that period of time were publically available in an online data base at the time. In one case, the necessary data was only available in the data base for year 2013 for unknown reasons. Alike, data for additional six firms was not available for year 2010. This can be seen as a limitation of this study, yet, the authors decided to not exclude the respected firms from the investigation, since the financial standing of 2013 still is of interest to meet objective one, i.e. to study the current state of economic distress in the industry. Further, the remaining data of those firms from 2011 to 2013 still contributes to a trend line for the industry and thus to fulfil the second objective in this study. Missing data is marked with "NA" in the empirical data below.

To generate a trend line for the industry from 2010 to 2013, year to year changes of the firms' Z'-scores were calculated in percent and averaged for the industry.

## DATA AND RESULTS

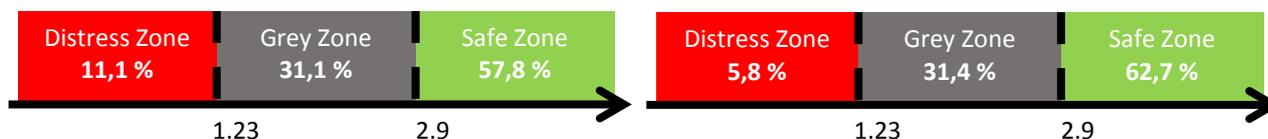
Table 1 shows the calculated Z'-scores for 52 Swedish firms producing wooden single-family houses for the years 2010 to 2013. For 2013, two firms, no. 15 and 22, do not exceed the first critical cut-off level of 1.23 for Z' and thus suffer from corporate economic distress, potentially facing bankruptcy. This equals 3.8%. Additionally, 19 firms, i.e. 36.5%, are located in the uncertain grey zone with a Z'-score between 1.23 and 2.9. At last, for 2013, 31 firms score higher than 2.9 and find themselves in healthy financial positions. This corresponds to almost 60% of the investigated firms.

**Table 1**  
**Z'-scores from 2010 to 2013 for 52 Swedish firms producing wooden single family houses**

firm no.	2010	2011	2012	2013	firm no. cont.	2010	2011	2012	2013
1	2,02	2,23	2,27	2,71	27	NA	1,70	3,32	1,47
2	1,92	2,33	3,24	3,15	28	4,12	4,48	4,19	5,70
3	NA	3,74	2,31	3,68	29	0,65	2,80	0,19	2,90
4	3,12	1,22	1,21	2,29	30	3,64	3,79	3,06	3,55
5	5,68	5,47	5,12	4,40	31	NA	3,40	3,69	4,17
6	1,04	1,17	1,34	2,90	32	3,56	3,94	3,51	3,88
7	3,02	3,15	3,42	2,53	33	4,43	4,23	3,76	4,44
8	NA	3,26	5,72	4,10	34	0,99	3,28	1,40	1,99
9	4,10	3,72	2,72	2,86	35	1,87	2,06	1,79	1,94
10	2,21	3,94	3,18	3,33	36	4,07	3,79	3,24	3,94
11	3,48	3,65	3,50	6,32	37	3,32	3,19	4,24	6,36
12	4,05	3,81	3,54	4,54	38	1,59	2,13	2,12	2,20
13	1,72	1,69	1,14	1,82	39	0,73	1,27	1,12	2,27
14	4,03	3,53	3,64	2,62	40	NA	2,98	2,35	2,57
15	NA	NA	NA	0,19	41	1,81	1,43	1,90	1,95
16	2,98	3,88	3,41	4,38	42	2,11	2,64	1,86	3,60
17	2,92	3,85	3,63	3,69	43	3,59	3,61	5,92	7,67
18	4,04	4,26	3,83	2,49	44	4,27	6,50	3,92	2,56
19	3,69	3,02	4,12	5,78	45	2,15	1,91	5,21	5,78
20	1,34	1,27	1,00	2,03	46	3,16	3,92	4,11	3,43
21	NA	2,43	2,09	2,26	47	3,44	5,09	6,31	5,48
22	-0,65	0,72	1,22	-0,31	48	2,23	2,55	3,34	5,54
23	1,39	2,27	1,80	1,80	49	3,70	2,97	5,78	5,49
24	3,97	4,48	4,02	5,52	50	2,57	2,52	3,36	2,17
25	4,60	6,70	4,56	6,67	51	2,76	3,07	2,63	2,91
26	3,54	4,63	3,80	4,18	52	6,54	3,02	6,30	9,28

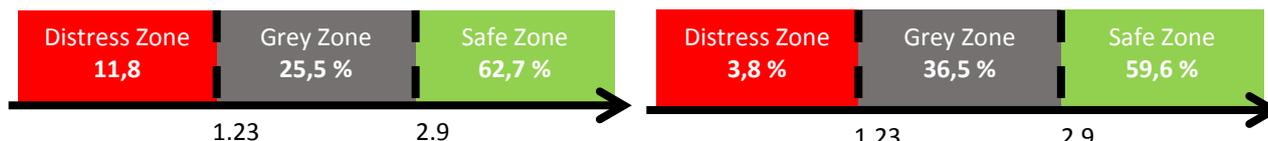
For 2012, the related numbers are 6 firms (11.8%) in distressed positions, 13 firms (25.5%) in the grey zone and 32 firms (62.7%) in the healthy zone. In 2011, 3 firms (5.8%) were located in the distress zone, 16 firms (31.4%) in the grey zone and 32 firms (62.7%) in the healthy zone. Finally, in

2010, 5 firms (11.1%) were financially distressed, 14 firms (31.1%) in the relatively uncertain grey zone and 26 firms (57.8%) in the save zone. The above described situation for the investigated firms is summarized in Fig. 2 to 5 below.



**Fig. 2.**  
**Percentage of firms in the respective Z'-score classification area in 2010**

**Fig. 3.**  
**Percentage of firms in the respective Z'-score classification area in 2011**



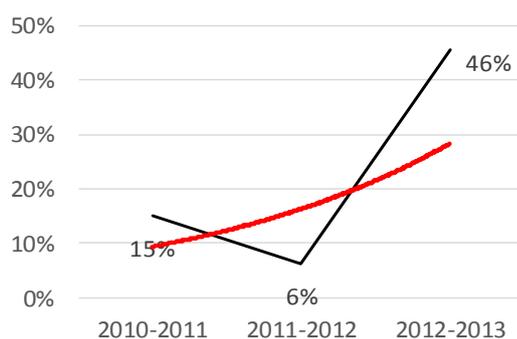
**Fig. 4.**  
**Percentage of firms in the respective Z'-score classification area in 2012**

**Fig. 5.**  
**Percentage of firms in the respective Z'-score classification area in 2013**

Studying Fig. 2 to 5 and Table 1 more in detail, movements of firms between the three classes can be found. In 2010, firms' no. 6, 22, 29, 34 and 39 were in the distress zone. Of these firms, only no. 6 and 22 still were in that class in 2011, whilst no. 29 and 39 moved into the grey zone and no. 34 improved its standing even more and was located in the safe zone. On the other hand, firm no. 4 downgraded its position from 2010 to 2011 from the safe zone to the distress zone.

Further, from the 14 firms in the grey zone in 2010, six were able to improve their Z'-score and were situated in the safe zone in 2013. These are no. 2, 10, 42, 45, 48 and 51. A reverse move from the safe zone in 2010 to the grey zone in 2013 was made by six firms, i.e. no. 4, 7, 9, 14, 18 and 44.

Considering the two firms that were in the distress zone in 2013, i.e. no. 15 and 22, the latter one was located in this zone all four years of investigation. Thus, it seems likely that this firm shows a strong tendency towards financial collapse and potentially needs to implement a financial reorganization strategy in order to avoid bankruptcy. Firm no. 15 was one of the firms with missing data for 2010 to 2012. Thus, it is not possible to see a trend in corporate financial distress. However, even in this case, serious strategic conduct is required to trigger a positive financial leverage that will improve this firm's standing.



**Fig. 6.**  
**Average year to year change in percent and trend line from 2010 to 2013 of Z'-scores of Swedish firms producing wooden single-family houses**

Looking at year to year changes in percent per firm, 35 out of 52 investigated firms could improve their Z'-score from 2010 to 2013. That corresponds to 67.3%. 15 out of 51 firms (28.8%) worsened their Z'-score, one firm had an almost unchanged Z'-score from 2010 to 2013 and for one firm, the necessary data was missing. Totalising the relative changes of the Z'-scores for all Swedish firms producing wooden single-family houses from year to year, an improvement of 15% can be

recognized from 2010 to 2011, additional 6% for the period 2011-2012 and finally an advancement of 46% from 2012 to 2013. This development is displayed in the solid line in Fig. 6, as well as the resulting exponential trend in the dotted line, showing an upward tendency of 38% for the investigated period 2010 to 2013.

## DISCUSSION AND CONCLUSION

Meeting the first objective of this study, the current corporate economic distress situation for Swedish firms producing wooden single-family houses was mapped. This was done by using Altman's Z'-score and the responding classification scheme. Results show that two firms are in the critical distress zone and likely will face bankruptcy. This equals 3.8% of the investigated firms, which is the lowest share of distressed firms in all investigated years. Furthermore, 19 firms (36.5%) are in the grey zone, being dependent on appropriate strategic action to develop their business in a positive manner. Finally, 31 firms (59.7%) are located in the safe zone. These firms are in favourable economic situations, compared to their competitors, which makes them to potential candidates for risk taking and investing in product differentiation or other necessary development to advance their firms towards wooden multi-family applications.

Working on the second objective, an evaluation of the corporate economic distress over a time period from 2010 to 2013 was performed and a trend identified. It can be concluded that the share of Swedish firms producing wooden single family-houses facing corporate financial distress decreased from 11.1% in 2010 to 3.8% in 2013. At the same time, the percentage of firms being in a financially healthy situation slightly increased from 57.8% to 59.7%. Even though some firms have a retrograde development, a positive trend of the industry as such exists. The average Z'-scores improvement of all firms in the industry is 38% from 2010 to 2013, whereby a major upturn can be identified for the period from 2012 to 2013. These numbers indicate that firms in this industry are recovering from the aftermath of the recession.

Considering the above it can be resumed that a major part of the Swedish firms producing wooden single-family houses find themselves in good or very good positions to invest in developing their businesses. This could be production equipment or knowledge in terms of technical or market expertise.

It would be hypothetical to assume that the firms, which develop against the positive trend in the industry, are the ones falling by the wayside. Nevertheless, considering that only 19-20 firms are needed to serve the existing Swedish market for wooden single-family houses (Schauerte *et al.* 2014), the mentioned firms need to improve their strategic conduct and implement efficient strategies not to prove that proposition. Another scenario could be that the firms with a positive development the past years take the step towards multi-family applications and leave more shares on the market for single-family houses. This could imply a chance for today's negatively developing firms to improve their standings.

The industry for wooden houses in Sweden is developing. More multi-family houses are planned to be built in wood, yet firms who can do that are few. Future research should therefore shed more light on potential players that could enter this market segment. This study indicates that many firms in the industry of wooden single-family houses could take such a step, solely looking at the economic background factors. Yet, what hinders these firms from taking that step? Maybe do perceived hinders by the firms' management exceed factual existing hinders. Studying that would as well require an exposure of technical hinders from single- to multi-family applications.

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